Factors Causing Variations in the Number of Manufacturing Investments across Kenyan Counties

Kosgei David k.
School of Business and Economics.
Moi University

Type of the Paper: Research Paper.
Type of Review: Peer Reviewed.
Indexed in: worldwide web.
Google Scholar Citation: AIJMR

How to Cite this Paper:
Kosgei, D. K., (2018). **Factors Causing Variations in the Number of Manufacturing Investments across Kenyan Counties.** *Africa International Journal of Multidisciplinary Research (AIJMR), 2 (5), 10-23.*

Africa International Journal of Multidisciplinary Research (AIJMR)
A Refereed International Journal of OIRC JOURNALS.

Africa International Journal of Multidisciplinary Research (AIJMR) ISSN: 2523-9430 (Online Publication) ISSN: 2523-9422 (Print Publication), Vol. 2 (5) 10-9, October, 2018 www.oircjournals.org

Factors Causing Variations in the Number of Manufacturing Investments across Kenyan Counties

Kosgei David k.
School of Business and Economics.
Moi University

ARTICLE INFO

Article History:
Received 12th September, 2018
Received in Revised Form 28th September, 2018
Accepted 3rd October, 2018
Published online 9th October, 2018

Keywords: Variations, Manufacturing, Investments, Counties, Negative Binomial.

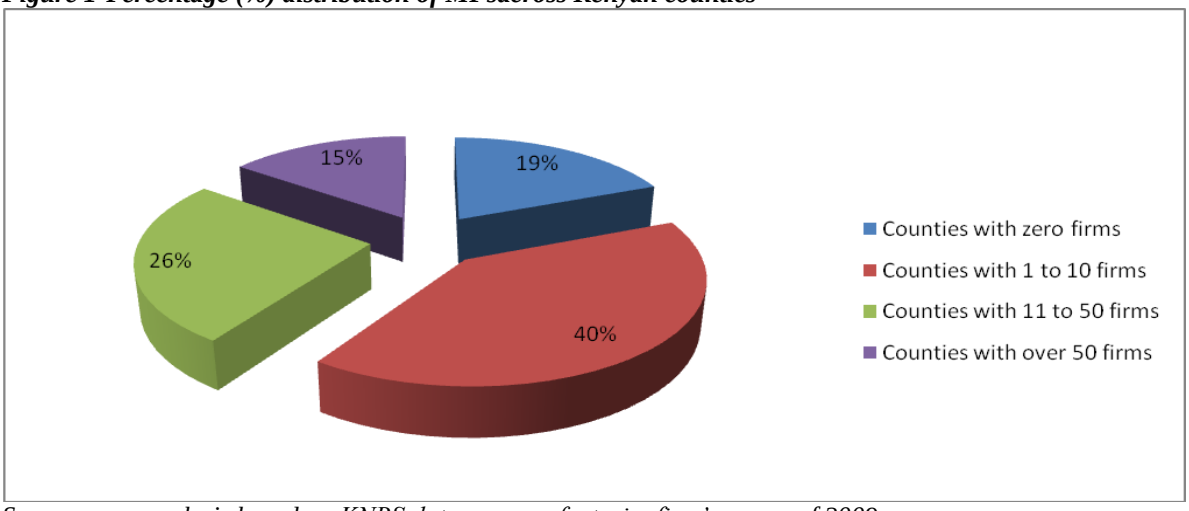
Abstract

Establishment of manufacturing firms in any given location is expected to impact positively on employment creation and poverty reduction. Kenyan counties are no exception hence for them to continuously address existing unemployment and poverty levels, attracting manufacturing firms becomes an important venture. However, all counties are not endowed the same way leading to variations in the number of manufacturing firms they have already attracted. This paper investigated the factors that cause these variations. The study employed Negative Binomial Regression model and has found out that insecurity level, agglomeration economies, availability of water, availability of roads and cost of land causes these variations. On strength of these findings, this study recommends on the need to reduce crime incidents in order to boost investor's confidence, enhance roads availability and also ensure adequate water for industrial purposes acrossthe counties. This can be done by availing more funds to both roads and water sectors. Further, provision of industrial parks with improved infrastructure around them will boost agglomeration economies for manufacturing firms and other investments. Also, since cost of land across counties may not reduce, leasing of industrial land to firms at a lower cost will attract and retain firms. It is envisaged that the recommendations herein will positively inform county leadership and if eventually actualized, counties will be on the right path towards addressing unemployment and poverty.

Introduction

Currently, there exists uneven distribution in the number of manufacturing firms (MFs) located in Kenyan counties as demonstrated by some counties having attracted over a hundred manufacturing firms (MFs) while others have attracted as few as zero firms (KNBS, 2010). This uneven distribution is further confirmed by National Industrial Policy Framework (NIPF, 2011), which indicates that MFs in Kenya has largely been concentrated in a few peri-urban and urban areas especially along Mombasa–Kisumu highway, resulting in disparity and un-equitable regional development. This is an indication that there may be barriers within some counties that make them not attractive to MFs as their preferred locations for investments. Stated otherwise, there exist some factors, which this paper investigated, that leads to variations in the number of MFs attracted across the counties.It is evident that Kenyan regions are not endowed the same way hence they exhibit various disparities (NIPF, 2011;Ng'ang'a and Njenga, 2010) which may be impacting in the number of MFs attracted across counties. The percentage distribution of the number of MFs in Kenya is summarized in figure 1 below.

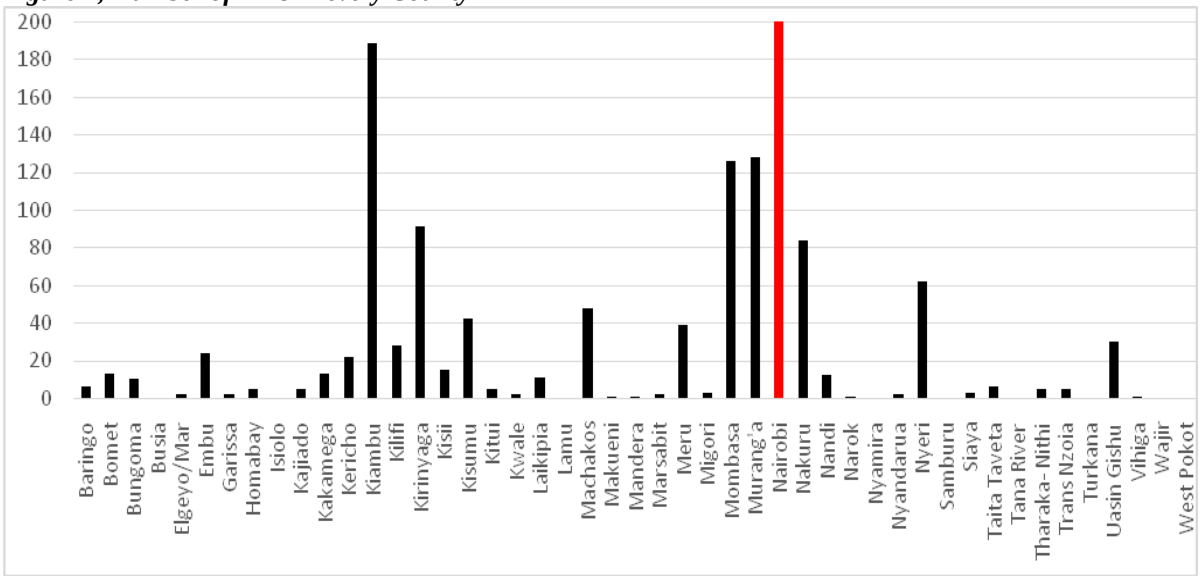
Figure 1-Percentage (%) distribution of MFsacross Kenyan counties



Source; own analysis based on KNBS data on manufacturingfirm's censusof 2009

Among the Counties that have not been able to attract even a single firm includes Tana River, West Pokot, Samburu, Turkana, Wajir, Busia, Lamu and Isiolo. Nairobi County has the largest number of MFs with 1053 firms. Other counties which have attracted over 50 MFs are Kiambu with 189 firms, Mombasa with 126 firms, Muranga with 128 firms, Kirinyaga with 91 firms, Nyeri with 62 firms and Nakuru with 84 firms. The rest of the counties have managed to attract between 1 and 49 firms as elaborated in figure 2 below.

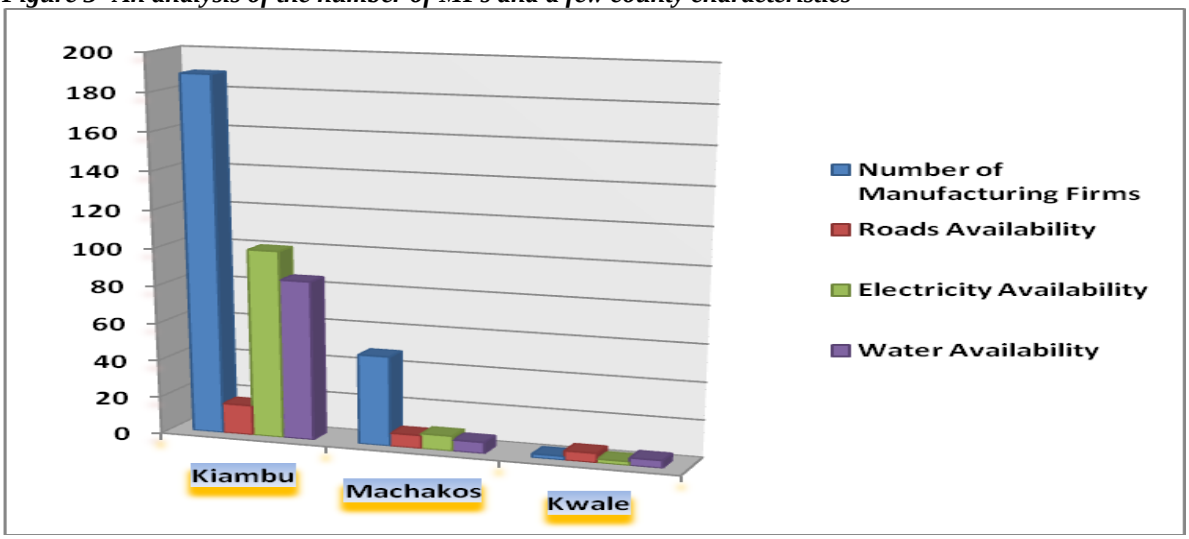
Figure 2; Number of MFs in every County



Source; own analysis based on KNBS data on manufacturing firm's census of 2009

As indicated by Combes *et al*., (2008), economists and geographers have always considered economic space as an outcome of a system of countervailing forces leading to economic landscape being characterized by disparities of varying degrees. As highlighted in figure 3, it is evident that some of these disparities may be impacting on the number of MFs attracted across Kenyan counties.

Figure 3- An analysis of the number of MFs and a few county characteristics



Source; own analysis based on data compiled from various sources

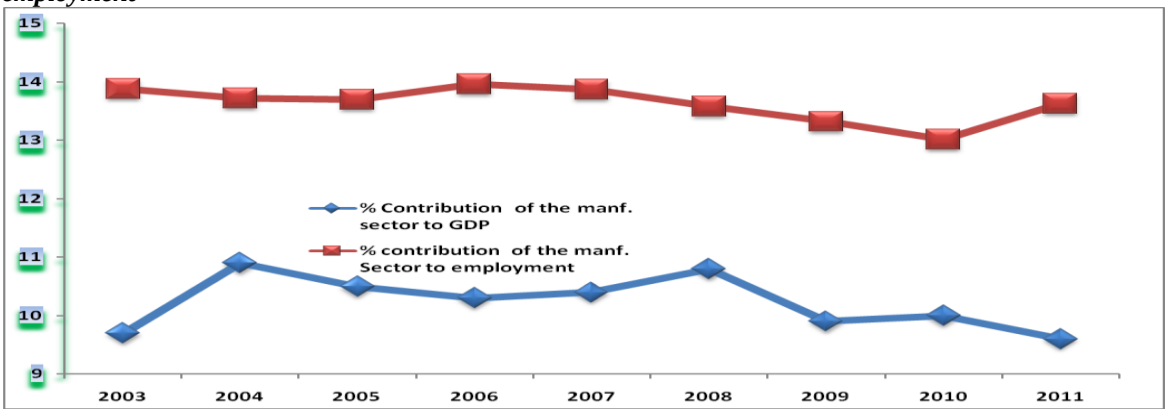
Figure 3 above is just for illustrative purposes whereby Kiambu has been chosen to represent counties with large number of firms, Machakos County to represent counties with mid level number of firms and lastly is the Kwale County representing counties with very few firms.

Contribution of manufacturing sector to economic growth and employment in Kenya

According to Kenya's vision 2030, growth of manufacturing sector is very important in terms of employment creation and economic growth. Foremost, the contribution of manufacturing sector in Kenya to economic growth has not been very impressive as evidenced by its contribution to GDP which has stagnated around 10 percent for relatively long period (KNBS, various statistical surveys). For the period 2003 to 2010, the average contribution to GDP was 10.3% while the average contribution to total wage employment was 13.6 percent. A total of 191,212 persons were employed as at the end of year 2010 (KNBS, 2011).

According to (KNBS, 2011) the contribution of the sector to economic growth and employment creation should be enhanced by removing barriers in investment, infrastructural growth, use of technology, promotion of exports among other interventions.The main industries contributing to the sectors economic performance and employment creation are food manufacturing, beverages and tobacco, textile and clothing, leather, furniture, petroleum, paper and metal products (KNBS, 2011). Manufacturing sector's contribution to economic growth and employment creation is as illustrated in figure 4 below.

Figure 4- Manufacturing sector contribution to GDPand employment



Source; own analysis based on KNBS data.

Following the enactment of the Kenya's new constitution 2010, county governments have emerged as the new units of devolution. The primary aim of this devolution was to promote equitable social economic development and provide easily accessible services throughout Kenya (Constitution of Kenya, 2010). To achieve the objectives of devolution, counties have been mandated to set their development agenda through handling a wide spectrum of functions geared towards addressing social economic challenges that affect them. As elaborated in Kenya's vision 2030, some of the key social economic challenges affecting all counties and the nation at large are unemployment, poverty and slow economic growth.

To tackle these challenges, Kenya's vision 2030 prescribes the need to have a robust manufacturing sector which involves nurturing of region specific manufacturing clusters since different Kenyan regions are suitable for different types of manufacturing activities. However, despite this prescription, there continues to be huge variations in the number of MFs located in various Kenyan counties. Nairobi county has attracted the highest number with 1053 firms followed by Kiambu County with 186 firms while some counties among them Wajir, Turkana and Samburu having been unable to attract even a single firm. This is clearly depicts huge variance and disparity.

The key concern is why should such huge variations in the number of MFs attracted across Kenyan counties exist. It is equally puzzling that a quick analysis of the results for the manufacturing firm's census conducted in year 2009 reveals that 83 percent of the counties have attracted less than the mean of 44 MFs per county. Secondly, given that counties are new units in Kenya, there is likelihood of existence of knowledge gap on how various location characteristics may be impacting on the number of MFs attracted in a given county. It was therefore critical to investigate these concerns as well as address the knowledge gap given that the growth of manufacturing sector is expected to tackle the policy problems of unemployment and poverty in all parts of the country.

Addressing unemployment and poverty is a national priority which requires urgent intervention measures key among them enhancing the growth of manufacturing sector clusters in all Kenyan regions (KNBS, 2011). The growth of the sector is anchored on development of industrial enablers throughout the country which are to serve as seed beds of Kenya's industrial take off (GOK, 2007) and ultimately propel the nation to be the preferred choice of basic manufactured goods in East and Central African markets.

Materials and Methods

As expressed by Arauzo and Manjon (2011) studies on location decisions of MFs are very heterogeneous in terms of theoretical approaches used, independent variables chosen and their measurements, methodologiesused and spatial areas considered. In this chapter therefore, synthesis of literature has taken into account this heterogeneity before finally giving anoverview on what has been adopted for this paper.

Industrial location analysis is anchored in location theory which finds its roots in the works of Weber (1929), Isard (1956) and most recently by economic geographers and other scholars like Hayter (1997) and Combes *et al.*, (2008) among others. According to Hayter (1997), the main theoretical approaches in regard to location theory are the neoclassical, behavioral and institutional approaches (Hayter, 1997).

Under neoclassical theory, the decision setting involves rational agents choosing optimally a site among a set of finite alternatives (Hayter, 1997). This implies that factors that attract firms in a given location are those affecting expected benefits derived from the decision to locate in a particular site and involves quantitative location characteristics such as land costs, transportation costs, agglomeration economies, human capital characteristics among others (Hayter, 1997, Arauzo and Manjon, 2011).

The behavioral approach is distinguished from neoclassical approach since it calls into question the assumptions of rationality and perfect information arguing that firms have limited knowledge to take their location decisions in a world of uncertainty (Figuerendo et al 2002, Hayter, 1997, Arauzo and Manjon, 2004). The behavioral approach therefore is concerned withinternal factors like firms own circumstances e.g. firm size, age,entrepreneurial ability, relations with consumers, etc which can influence firm's location decisions (Figuerendo *et al.*, 2002, Hayter, 1997, Arauzo and Manjon , 2004).

Lastly, the institutional approach argues that firms are not isolated agents but operate within the framework having regional systems, governments, clients, competitors and other public policy

institutions (Arauzo and Manjon, 2004 and 2011 and Hayter, 1997). Hence, these other institutions make decisions that potentially modify the attractiveness of sites. Empirical evidence on this is provided by studies by Bartic (1985), Woodward (1992) and List and McHome (2000).

Various empirical studies have used different methodological approaches, different variable measurements, different units of locations and even their findings have been different.

The broad categories of spatial variables that attract MFs includes infrastructural characteristics, input market characteristics, output market characteristics, labour characteristics and agglomeration economies (Badri, 2007; Arauzo and Manjon, 2004 and 2007; Basile, 2004; Cieslik, 2005; Samik and Sanjoy, 2005; Guimaraes *et. al.*, 2004 and Holl, 2004a). Infrastructural characteristics include cost of various means of transport, availability and cost of various means of communication, availability and cost of warehousing and storage facilities, accessibility and cost of electric power, accessibility and cost of water and availability of financial institutions and related financial costs.Input market characteristics include proximity, cost and size of raw materials and availability and cost of land. Output market characteristics are size of output market, distance and cost of transportation to the output market, preferences and potentiality for future expansion of output market .Labour characteristics are availability of labour, cost and skills of the labour force while agglomeration economies comprise of urbanization and localization economies.

In regard to the choiceof models used in industrial location, Discrete Choice Models (DCM) and Count Data Models (CDM) have been used extensively. According to Arauzo and Manjon (2004 and 2007), Becker and Henderson (2000) and Guimaraes *et al.,* (2004), the two models are consistent with the idea of firms choosing optimal locations subject to standard constraints. UnderCDM, the unit of analysis is the location and the concern is the factors of that location that may affect location decisions while under DCM, the unit of analysis is the firm and the main concern is how certain characteristics of the firm e.g. size affect location decisions (McFadden, 1974, Arauzo and Manjon, 2007). Under CDM, studies by Cieslik and Ryan (2006), Arauzo and Manjon (2007), Barbosa *et al.,* (2004) and Otsuka (2008) have used Poisson Regression Models (PRMs) while studies by Coughlin and Segev (2000); Cieslik (2005), Holl (2004); Henderson and McNamara (2000) and Arauzo (2008) used Negative Binomial Models (NBMs). Under DCM, studies by Bartic (1985), Woodward 1992 Guimaraes *et al.,* (2002; 2004), McNamara and Kriesel (1991) used Maximum Likelihood Estimate (MLE) on Conditional Logit Model (CLM).Studies by Goetz (1993), Henderson and McNamara (1997) and Brown *et al.,* (2009) used Ordinary Least Square (OLS) technique.

Since various empirical studies have used different variables, literature on variable measurements has been restricted to only those variables used in this paper. In relation to agglomeration economies, focus on MFs per square area has been adopted by Rosenthal and Strange (2003), Figueiredo et al., (2002), Bartic (1989) and Guimaraes (2004). Lambert *et al.,* (2009) divided the number of MFs with total number of business establishments in a county while Lambert et al. (2006) used the percentage of those employed in MFs per county. Cieslik (2005), used number of MFs while Akihiro (2008) and Henderson (2000) measured agglomeration economies by the number of MFs in a region divided by regional population. Finally, Arauzo and Manjon (2011) usednumber of workers inthe industrial sector divided by area.In regard to roads availability, Cieslik and Ryan(2005) and Fernandez and Sharma (2012)used total length of the roads while Coughlin *et al.,* used road length divided by area.In regard to measuring the cost of land, Figuerendo et al., (2002) used population density, Lambert & McNamara. (2009) used county area, while McNamara & Kriesel (1991) used price per acre of land. Muluvi, (2011) used choice variable to proxy access to land as a factor under business environment.Concerning insecurity, Fernandez and Sharma (2012) usedper capita murder rate as a determinant of clusters in Indian manufacturing.Lastly, various empirical studiers have used various dummy variables to capture regional effects. Arauzo and Manjon (2011) used a dummy variable for shore lines inorder to determine whether industrial location favored coastal regions, Henderson & McNamara (2000) used a dummy variable to capture the effect of a city on industrial location and Figueiredo *et al.,* (2002) included a dummy variable to account for state level characteristics.

In terms of empirical results, availability of road infrastructure has been found to influence firm's location decisions (Basile, 2004; Cieslik, 2005; Coughlin and Segev, 2000; Holl 2004a and Coughlin *et al.,* 1991). Secondly, land availabilityhas been found to influence firm's location decisions (Bartic, 1985; Papke, 1991; Woodward, 1992 and Figuerendo *et al.,* 2002).

Further, agglomeration economies have also been found to influence industrial location (Arauzo and Manjon, 2004 and 2007; Autant, 2006; Basile, 2003 and 2004; Guimaraes *et. al.,* 2000 and 2004; Woodward, 1992 and Arauzo, 2005). Studies by Coughlin *et al., (*1991), Woodward (1992), Arauzo and Manjon (2004), Barbosa (2004), Becker and Henderson (2004) and Cieslik (2005) found labour availability as a determinant of firms' location decisions. A Study by Carlton (1983) found energy price as a significant determinant of industrial location. Studies by Guimaraes *et al., (*2000), Woodward (1992), Holl (2004a), List (2001) and Lambert and McNamara (2008) found out that product market influences firms' location decisions. Availability of raw material was found to influence firm's location decisions by studies by Goetz (1993), and Henderson and McNamara (1997 and 2000).

Finally, studies by Woodward (1992) in USA, Arauzo and Manjon (2004) in Spain, Arauzo (2008) in Spain, Becker and Henderson (2000) in USA, Coughlin and Segev (2000) in USA, List (2000) in USA, Guimaraes (2004) in USA have considered counties as their location for analysis. Studies by Holl (studies by Bartic 2004a) in Portugal, Manjon and Arauzo (2007) in Spain studied municipalities while Basile (2004) in Italy considered states as the locations. Finally, a study by Figuerendo *et al.,* (2002) in Spain used districts as the location of analysis.

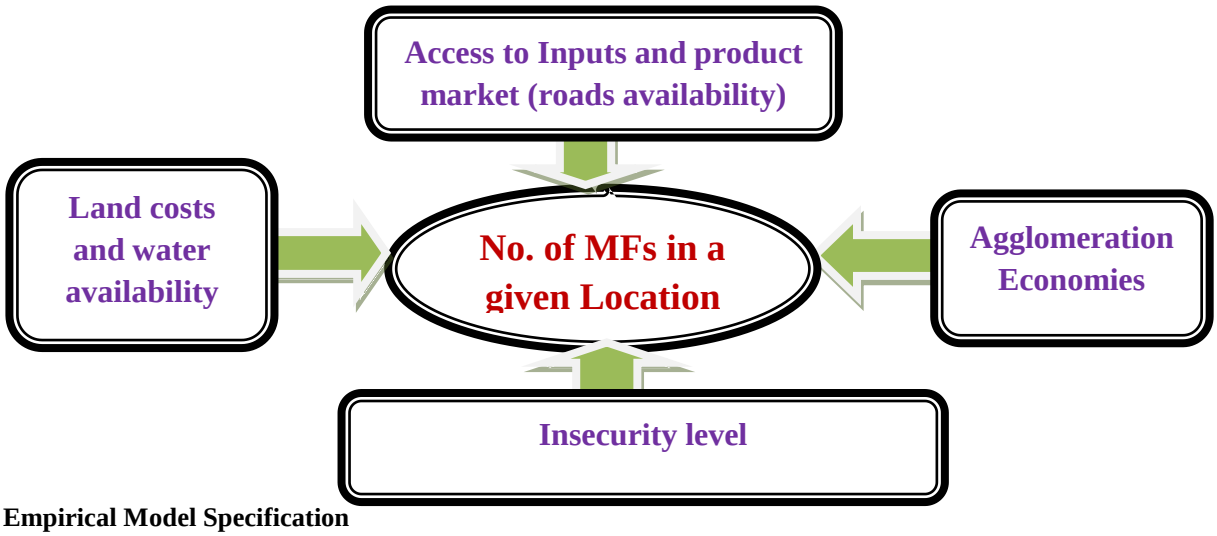
Owing to the fact that this study lays more emphasis on locational characteristic of Kenyan counties then the most appropriate theoretical approach to inform the conceptual framework is the neoclassical approach since it focuses on locations as the units of analysis. Due to lack of firm level data on firm's behavioral characteristics across all counties, the behavioral approach cannot be focused upon. Further, given that institutional approach may require the presence of operational county governments, then focusing on this theoretical approach cannot be feasible for the Kenyan case as at now. It is important that future studies should try and focus on these approaches.

It is evident that empirical research on industrial location in African economies is not extensivean indication of knowledge gap especially for a country like Kenya which has now embraced devolved governments. Secondly, insecurity level and availability of water has not been extensively considered in many studies probably because western countries where the majority of such studies have been done have limited internal security and water challenges. This therefore serves as a motivation to include the two variables in this study given that they are a major concern in Kenya (RPED, 2004) and also since the two are hypothesized to influence location decisions (Badri, 2007). Land remains a major issue in Kenya hence it will also be critical to investigate its role in industrial location.

Lastly, given that the number of MFs attracted in counties is count in natureand that firm level data on industrial location determinants for all counties is unavailable, this paper has therefore chosen to use CDM in the analysis as detailed in section 3.2.As indicated by Cameron and Trivedi (1998), the nature of data available to econometricians, including how it has been measured, may dictate the use of count models regardless of the economic theory.

The conceptual framework for this study was drawn from the neoclassical theoretical approach since the focus of this study is the industrial location as opposed to the locating firm. A location model is used to provide a conceptual basis for specifying the manufacturing firm's establishment (Goetz, 1997; Henderson and McNamara, 1997 & 2000; Guimaraes *et al.,* 2004; Samik & Sanjoy, 2005 and Brown *et al.,* 2009). Weber (1929) opines that optimal location selection by a firm is a trade-off between transport costs of inputs to production facilities, and outputs to product markets. Further, according to Weber (1929), Isard (1956) and Hayter (1997), the ability of a given location to attract MFs will depend on the characteristics of the location relative to the levels of the same characteristics in another location, an indication that the number of firms attracted in a given location may be consistent with location's comparative advantage.

Therefore, location theory is concerned with the geographic location of economic activityand is often used as a framework for analyzing the firm's establishments in various locations and location decisions of manufacturing firms (Smith *et al.,* 1978; Barbosa *et al.,* 2004; Arauzo and Manjon 2007, Lambert and McNamara, 2008; Otsuka, 2008 and Brown *et al.,* 2009). Under location theory, various locations characteristics affect firm's establishments in those locations.As has been expounded in literature, location characteristics that attractMFsare enormous. However, this paper has conceptualized the following characteristics as to affect the number of MFs attracted in Kenyan counties.



Empirical Model Specification

Owing to the fact that the dependent variable is a count,and it would be critical for this study to capture the nine Kenyan counties with zero counts, then Count Data Model (CDM) becomes more applicable in this study as compared to Discrete Choice Model (DCM).Under CDM, zero observations not only contribute to the likelihood function but also provide interesting insights about data generation process (Lambert *et al.*, 2006; Mullahy 1997, Cameron and Trivedi 1998).The advantage of CDMs rest on the assumption of a discrete probability distribution for the count variables, followed by the parameterization of the mean of the discrete distribution as a function of explanatory variables (Winkelmann, 2008; Lambert *et al.*, 2006 and Cameron and Trivedi, 1998). Drawing from Guimaraes *et al.*, (2003) and Greene (1994), it will therefore be appropriate for this study to avoid DCM since the likelihood function is always zero for those locations that have not attracted any firm.

Under CDM, the industrial location decisions can be empirically examined by calculating how changes in location characteristics affect the number of firms attracted in location ***j*** in a given period of time (Becker and Henderson 2000; Arauzo 2005 and 2008 and Otsuka 2009).Although, several types of discrete probability distributions may be considered in modeling count data, the workhorse discrete distributions are the Poisson and the negative binomial (NB) distributions (Winkelmann, 2008;Cameron and Trivedi, 1998; Basile, 2004; Arauzo, 2005; Autant, 2006 and Alanon *et al.*, 2007).The advantage of the Poisson Regression Model (PRM) and Negative Binomial Models (NBM) is that they explicitly recognize the non-negative integer character of the dependent variable (Winkelmann, 2008; Lambert *et al.*, 2006; Cameron and Trivedi, 1998 and Greene, 1994). PRM accounts for the observed heterogeneity (observed differences among sample members) by specifying the count dependent variable as a function of observed independent variables (Winkelmann, 2008, Long and Freese, 2001Cameron and Trivedi, 1998). PRM achieves this byassuming that the number of firms (y_i) observed in location ***i***, is drawn from Poisson distribution with parameter λ_i related to the independent variables vector x_i that represents a set of regional characteristics (Lambert *et al.*, 2006;Arauzo 2005 and 2008;Alanon *et al.*, 2007; Autant, 2006 and Basile, 2004).

Following Becker and Henderson (2000), Arauzo and Manjon (2004), Alanon *et al.*, (2007), and as extensively explained by Winkelmann (2008) and Cameron and Trivedi (1998), λ_i is defined as an exponential function of a linear index of the explanatory variables***x***in order to account for observed heterogeneity i.e $\lambda = \exp(\beta_1 + \beta_2 x_2 + \ldots + \beta_k x_k)$. This exponential form ensures that λ_i remains positive for all possible combinations of parameters and explanatory variables (X_i).

Consequently, the expected value of y_i is given as;

$E [y_i/ x_i] = var[y_i/ x_i] = \lambda_i = e^{\beta' x_i}$……1

Equation1 above is linearized as follows;

$\ln\lambda_i = \beta' x_i$ ……2

As explained by Cameron and Trivedi (1998), as in standard regression analysis, modeling of count data requires supplementing estimation with additional tests to determine whether the fitted model is adequate and whether a specific deficiency of any initially entertained model can be removed by progression to a less restrictive model. Consequently, this calls for conducting misspecification tests designed to highlight inadequacy of the maintained model in specific directions (Winkelmann, 2008; Cameron and Trivedi, 1998; Greene, 1994). The misspecifications tests are anchored on various assumptions of Poisson distribution as given below.

Foremost, the key assumption of the Poisson model is that the mean and variance are equal (Mullahy 1997, Cameron and Trivedi, 1998 and Winkelmann, 2008). Owing to overconcentration of firms in some counties as elaborated in figure 2, the variance for the dependent variable is greater than the mean a situation called over-dispersion problem.Over dispersion arises from the existence of unobserved heterogeneity in conditional mean parameter (Mullahy1997, Cameron and Trivedi 1998 and Winkelmann 2008) and implies that inferences from maximum likelihood estimates are no longer valid. From table 3b, given that the variance for the dependent variable is 24171.94 and exceeds the mean of 44.62 by a huge figure of 24127.82the use of a PRM becomes inappropriate hence an initial justification for the use of a compound Poisson distribution like NB distribution.

The NBM is a generalization of the Poisson, where the variance of the distribution is allowed to be different from the mean and is motivated by desire for a greater flexibility to account for frequently observed over dispersion in data and to provide for a better fit (Cameron and Trivedi 1998).This implies that the over-dispersion problem is accounted for by a more accurate modeling of variance (Arauzo, 2005 and 2008; Lambert *et al.*, 2006; Holl 2004a; Coughlin and Segev, 2000).

Beyond NBM accounting for the observed heterogeneity (observed differences among sample members) just like the PRM, it also allows for multiplicative unobserved heterogeneity into the conditional mean (Long and Freese, 2001) by assuming that;

$E [y_i/ x_i, \varepsilon_i] = e^{[(\beta' xi)+\varepsilon i]} = \lambda_i\varepsilon_i$……3

Where ε_i has gamma distribution with unitary mean and constant variance α (Cameron and Trivedi 1998 and Winkelmann 2008). Thus the expected value of y_i in the NBM is exactly the same as in the Poisson model but variance differs and exceeds the mean as indicated below;

$Var [y_i/ x_i] = E[y_i/ x_i][1+\alpha E (y_i/ x_i)$……4

The second assumption of the Poisson involves an excess of zero counts whereby a problem arises if their number is excessive (Winkelmann 2008; Cameron and Trivedi 1998; Greene, 1994). In case of excess zeros, zero inflated NBM is used since it assumes a degenerate distribution whose mass is concentrated at zero (Arauzo and Manjon 2007). However, zero inflated NBM requires theoretical underpinning that some locations are ineligible for a response (Winkelmann, 2008). However, this cannot be feasible since there is no theoretical underpinning or any form of restriction that any given county in Kenya is eligible for a non-zero response in terms of attracting MFs. The only apparent scenario is that in nine Kenyan counties, the response has not yet occurred.

Consequently, owing to over dispersion problem and the fact that all Kenyan counties are eligible for a count, then drawing from equation 3 above, this study has employed the NBM fully specified below;

$$\ln y_i = \omega + \beta_1 \text{INSECURITY}_i + \beta_2 \text{AGGLOMERATION}_i + \beta_3 \text{WATERACCESS}_i + \beta_4 \text{ROADSAVAILABILITY}_i + \beta_5 \text{COSTOFLAND}_i + \beta_6 \text{REGIONALDUMMY}_i + \varepsilon_i \quad \ldots\ldots 5$$

The choice of independent variables has been informedby two reasons. Primarily, majority of the variables are those that can be altered especially in the short run by both the county and/or the national government. Secondly, as highlighted in the literature, insecurity level, water access and cost of land have least been investigated and are key concerns in Kenya. The dependent variable (y_i) in equation 5 is the count of MFs observed in county ***i*** and which is drawn from NB distribution with parameter λ_i defined as in equation 3, and which is related to the county characteristics on the RHS as well as to the unobserved heterogeneity in various counties given by ε_i

The study used cross sectional data gathered from various sources

Results and Discussion

Summary Statistics

The results of summary statistics are given in table 3a and 3b below.
Table 3a –Summary Statistics

Variable	Number of Observations	Mean	Standard Deviation	Minimum	Maximum
MFs	47	44.61702	155.4733	0	1053
Insecurity level	47	0. 268353	0. 2485892	0. 03315	1.52503
Agglomeration	47	5.130099	23.38772	0	151.5108
Water accessibility	47	44.54633	14.47062	14.9891	75.69897
Roads availability	47	87. 73787	90. 51038	6.66	435
Cost of land	47	405.8615	882.5898	4.1	4516
Regional dummy	47	2.297872	0.5866224	1	3

Source: Data analysis

From table 3a above, the number of observations is 47 implying that all the 47 Kenyan counties have been brought on board including all the variable measurements. In regard to agglomeration economies, cost of land, insecurity level and roads availability, the mean is quite close to the minimum value an indication that there exists some extreme values/ disparities between some counties on these characteristics. Given the mean measure of water accessibility is 44.54633 and that the minimum and maximum measures are 14.9891and 75.69897 respectively, then per capita household's access to improved water does not exhibit very huge disparities across counties.

Table 3b –Detailed summary statistics for the dependent variable (Manufacturing Firms)

	Percentiles	**Smallest**		
1%	0	0		
5%	0	0		
10%	0	0	**Observations**	47
25%	1	0	**Sum of Weight**	47
50%	5		**Mean**	44.61702
		Largest	**Std. Deviation**	155.4733
75%	28	126		
90%	91	128	**Variance**	24171.94
95%	128	189	**Skeweness**	6.006992
99%	1053	1053	**Kurtosis**	39.33019

Source: Data analysis

From *Table 3b*, it is evident that there is non-equality of the mean (44.62) and the variance (24171.94) of the dependent variable which is an indication of overdependence. The implication of this is that the appropriate regression model should be a compound Poisson model like Negative Binomial Model which takes into account non equality of the mean of the mean and variance.Given that the mean of the dependent variable is 44, minimum value is 0 and the maximum value is 1053, then the implication is that the number of MFs attracted across counties exhibits substantial disparity.

Regression Results
The econometric software of stata was used to generate the regression results on effects of various factors in attracting MFs in Kenyan counties as presented in table 4.

Table 4 –Negative Binomial Regression results

Negative Binomial Regression	Number of obs= 47 LR chi2(7) = 66.23 Prob> chi2 = 0.0000 Log likelihood = -158.05047 Likelihood ratio test of alpha=0: chibar2(01) = 405.13 Prob>=chibar2 = 0.000 Dep. Variable = Manufacturing firms
Variables	**Coefficients Standard errors**
constant	1.5564681.41843
Insecurity	-2.992324*****1.194525
agglomeration	0.03418***** 0.0158144
Water avail	0.0248206*****0.0120589
Roads avail	0.0237278*****0.0057809
Cost of land	-0.0024218*****0.0006797
regionalDummy2	-0.7962587 1.233718
regionalDummy3	-1.222784 1.377648
	Notes; * implies significant at 5%

Source: Data analysis.

From results in table 4, three critical issues are evident. Foremost, all counties even those with zero observations have been captured by the NB regression as evidenced by 47 as the number of observations. Secondly, theloglikelihoodchi2 (7) given as 66.23 has prob>chi2 = 0.000. Since the prob>chi2 is significant, we reject the null hypotheses that all the regression coefficients are simultaneously equal to zero implying that the variables used are joint determinants of the number of manufacturing firms attracted across Kenya counties. Thirdly, the chibar2 (01) =405.13 (this is the likelihood ratio chi-square test that the dispersion parameter alpha is equal to zero) is large and the Prob>=chibar2 = 0.000 is significant. This suggests that the dependent variable is over dispersed and is not sufficiently described by Poisson model.

From the results, insecurity level, agglomeration economies, water accessibility, availability of roads and cost of land are significant determinants of the number of MFs attracted across Kenyan counties. They are all significant at 95 % confidence level. Findings on insecurity are consistent with RPED (2004) and Fernandez and Sharma (2012) while findings on agglomeration economies concurs with those of Rosenthal and Strange (2003) and Guimaraes (2004). Further, findings on roads availability concurs with Cieslik and Ryan (2005), Fernandez and Sharma (2012) and RPED (2004). Findings on water access reinforce Kenya's vision 2030 which states that water supply is critical for manufacturing sector development. Findings on cost of land are consistent with Figuerendo *et al.,* (2002) and McNamara & Kriesel (1991).

Taking the case for insecurity, for a unit increase in insecurity level, the difference in the logs of expected counts of the MFsis expected to decrease by the 333.48 units (which is also equivalent to a decrease by 95 percent of the expected counts of the MFs given the other predictor variables in the model are held constant.Secondly,for a unit increase in agglomeration economies, the difference in the logs of expected counts of the MFsis expected to increase by 0.0276 units (which is also equivalent to an increase by 3.5 percent of the expected counts of the MFs) given the other predictor variables in the model are held constant. Thirdly, for a one unit increase in water availability, the difference in the logs of expected counts of the MFsis expected to increase by 302.66 units (which is also equivalent to aincreaseby2.5 percent of the expected counts of the MFs) given the other predictor variables in the model are held constant. Further, for a one unit increase in roads availability, the difference in the logs of expected counts of the MFsis expected to increase by 0.018 units, units (which is also equivalent to an increase by 2.4 percent of the expected counts of the MFs) given the other predictor variables in the model are held constant. Finally, for a one unit increase in cost of land, the difference in the logs of expected counts of the MFs is expected to decrease by 0.00178 units (which is also equivalent to a decrease by 0.2 percent of theexpected countsof the MFs) given the other predictor variables in the model are held constant.

Although the results reveals that there is no statistically significant difference between the two regions analyzed and the city region, it is worth noting that the implication for this is that that arid

and semi arid counties should consider promotion of manufacturing as an economic and development policy and not view this as a policy favoring developed regions like cities.

Conclusion and Policy Recommendations

Conclusion

This paper sought to analyze the impact of various location characteristics on the number of MFs attracted across Kenyan counties. By employing Negative Binomial Regression technique, the study has found out thatinsecurity level, agglomeration economiesavailability of water, availability of roadsand cost of land affect the number of MFs attracted across Kenyan counties. However, it is worth noting that some variables under institutional theoretical approach like business permit charges, which are theorized to impact on firm's location decisions(and which will be within the scope of county governments to handle as per the constitution of Kenya, 2010) have not been captured since county governments were not operational during the time of this study.

Policy Recommendations

The above findings are important for county's development agenda especially if the focus is to attract MFs as a key strategy of reducing unemployment and poverty.

Foremost, County leadership should focus on reducing crime incidents in order to boost investor's confidence and thusattract andretain MFs and by extension other investments in the county. This can be done by complementing and supporting initiatives like community policing aimed at curbing crime incidents and also by organizing forums between county leadership and the public to dialogue on security concerns. Any other venture believed to reduce criminal incidents likesupport for youth empowerment ventures, strengthening dispute resolution mechanisms and maintaining peaceful coexistence between communities needs to be pursued. The national government should on its part sustain and supportpolice reforms as a long term strategy of curbing insecurity. Lastly, counties also need to establish systems of monitoringthe effects of crime incidents on existingand prospective firms.

Secondly, County leadership should support locations where firms' have agglomerated through infrastructural support in order to further reduce firm's operating costs. Provision of external services to existingfirms and other investments should be supported preferably at a subsidized cost.Also, designating special sites and providing infrastructural support will attract firms to agglomerate around such sites. Given that counties have been mandated to handle trade issues and countyplanning (Constitution of Kenya, 2010), they should purpose to develop industrial parks as models resembling export processing zones and /or special economic zones to attract more firms and thus reap the benefits of agglomeration economies.Rural counties where agglomeration economies level is low but land is cheap and available can capitalize on establishing such parks as a way of attracting MFs.

Given that most of MFs in Kenya are involved in agri-based processing (KNBS, 2010) and that sustainable agricultural production in Kenya is primarily anchored on availability of water, then increasing water accessin counties will go a long way in supporting agri based processing. Water providers in the counties can supply industrial water at subsidized rates. Firms can also be allowed to directly tap industrial water from sources within the counties.

As per the constitution of Kenya (2010), counties have been mandated to handle county public works hence channeling of funds to projects that can increase roads connectivity and availabilityis a positive strategy for attracting MFs and other investments.The national government through its various road authorities should sustain road construction and repairs. Further, support of other transport means to ease pressure on roads should be encouraged.

Lastly, since it is highly unlikely that land costs will reduce, then county leadership should consider leasing of land to MFs at a lower cost as an alternative. This will in turn make the county reap the benefits of local employment, market for local goods and other benefits. If this is not done, such MFs may be obliged to locate in counties exhibiting more flexibility on land availability at subsidized cost.

References

Alanon, A. Arauzo- Carod, J.M. and Myro, R. (2007), "Accessibility, agglomeration and location," *in J.M. Arauzo-Carod and M. Manjon-Antolin,Chentelham*: Edward Elgar, pp. 247-267.

Arauzo-Carod, J.M. and Manjón-Antolín, M. (2011), "(Optimal) Spatial aggregation in the determinants of industrial location", *Small Business Economics*, forthcoming.

Arauzo, Josep M. (2005), "Determinants of industrial location. An application for Catalan municipalities," *Papers in Regional Science*, 84, 105–120.

-(2008), "Industrial location at a local level: comments on the territorial level of the analysis," - *Journal of Economic & Social Geography* **99**, 193-208.

Autant-Bernard, Corinne (2006), "Where do firms choose to locate their R&D? A Spatial Conditional Logit Analysis on French Data," *European Planning Studies*, 14, 1187–1208.

Badri, A. M. (2007), "Dimensions of industrial locations factors", *in journal of business and public affairs*, vol. 1, issue 2.

Bartik, Timothy J. (1985), "Business location decisions in the U.S," *Journal of Business and Economic Statistics*, 3, 14–22.

Brown, J. P., Florax, R. M. & McNamara, K. T. (2009), "Determinants of investments flows in US manufacturing" working paper 09-10, Sept. 2009

Cameron, A.C. and Trivedi P.K. (1998), *Regression Analysis of Count Data*, CUP.

Cieslik, Andrzej. (2005a), "Location of foreign firms and national border effects: The case of Poland,"*Journal of Economic & Social Geography*, 96, 287–297.

Combes P. P., Mayer T. & Thisse J. F.(2008),*Economic Geography*, Princeton University Press, New Jersey.

Coughlin, Cletus C. and Eran Segev (2000), "Location determinants of new foreign-owned manufacturing plants," *Journal of Regional Science*, 40, 323–351.

Guimaraes, P., Figueiredo, O., and Woodward, D. (2004), "Location modeling and localization of Portuguese manufacturing", unpublished Manuscript, University Of South Carolina.

-(2002), "Modeling industrial location decisions in US counties," *Working paper series - 18.*

-(2000), "Agglomeration and the location of Foreign Direct Investment in Portugal," *Journal of Urban Economics*, 47, 115–135.

Greene, William H. (1994), "Accounting for excess zeros and sample selection in Poisson and NB Regression Models," *Discussion Paper No. EC-94–10*, Department of Economics, New York.

Goetz, S. (1997),"State- and county-level determinants of food manufacturing establishment growth: 1987-93", *Amer. J. Agr. Econ* 79 (August 1997): pp. 838-50.

GOK (2010), *The Constitution of Kenya, laws of Kenya*, Government printer, Nairobi.

GOK (2010), *National Industrialization Policy Framework for Kenya*, Ministry of Industrialization.

GOK (2007), *Kenya Vision 2030: A Globally, Competitive and Prosperous Kenya*, Nairobi, Ministry of State for Planning, National Development and Vision 2030.

Hayter, Roger (1997), *The dynamics of industrial location the factory, the firm and the production system*. Chichester, UK: Wiley.

Henderson, J. R. & McNamara K. T. (2000), "The location of food manufacturing plant investments in corn belt counties"*in Journal of Agricultural and Resource Economics*, Vol. 25, No. 2, pp. 680-697

Henderson, J. and McNamara K. T. (1997), "Community attributes influencing local food processing growth in the U.S. cornbelt." Can. J. Agr. Econ. 45 235-50.

Holl, Adelheid (2004a), Transport infrastructure, agglomeration economies, and firm birth. Empirical evidence from Portugal. In: *Journal of Regional Science* Vol. 44 pp. 693-712.

Isard, W. (1956), *Location and space-economy; a general theory relating to industrial location, market areas, land use, trade, and urban structure*, Cambridge.

Kenya National Bureau of Statistics (KNBS) (2007), *Kenya Integrated Household Budget Survey*, 2005/06, Volume I Basic Report, Nairobi.

Kenya National Bureau of Statistics (KNBS) (2007), *National Population and Housing Census report* 2009, Nairobi.

Kenya National Bureau of Statistics (KNBS) (forthcoming), *Manufacturing Firms Census report2009*. Nairobi,

Kenya National Bureau of Statistics (KNBS) (various), *Statistical Abstracts and Statistical Surveys*Government Printer, Nairobi.

Lambert, D.M., McNamaraK. T., and GarrettM. I. (2006), "An application of spatial Poisson models to manufacturing investment location analysis," *Journal of Agricultural and Applied Economics*, 38, 105–121.

Lambert D. M. & McNamara K. T. (2009), "Location determinants of food manufacturers in the United States, 2000–2004: are nonmetropolitan counties competitive?" in the Journal of Agricultural Economics 40, 617–630

Lee, Y. (2008), Geographic redistribution of US manufacturing and the role of state development policy". In: *Journal of Urban Economics* Vol. 64 pp. 436-450.

List, John A. (2001), "US county-level determinants of inbound FDI: Evidence from a Two-Step Modified Count Data Model," *International Journal of Industrial Organization*, 19, 953–973

Manjon, Miguel and Josep M. Arauzo (2007), "Locations and relocations: modelling, determinants, and interrelations,"Working Paper No.6–2007 Department of Economics URV.

Marshall, Alfred (1890), *Principles of Economics*. MacMillan.

McFadden, Daniel. (1974), "Conditional logit analysis of qualitative choice behaviour," in P. Zarembka (ed.) *Frontiers in Econometrics*. Academic Press, pp. 105–142.

McNamara, K. T. &Kriesel, W. (1991), "A county level model of manufacturing plant recruitment with improved industrial site quality management", *in Southern journal of agricultural econ*, July 1991

Moomaw, R.L., Mullen, J.K. & Williams, M. (1995), "The interregional impact of infrastructure capital*", in Southern Economic Journal*, 61(3), pp. 830-45

Mullahy, J. (1997), "Heterogeneity, excess zeros, and the structure of count data models" in*Journal of Applied Econometrics* 12: pp. 337-350.

Muluvi, A. S. (2011), "Firm level determinants of investment in the Kenyan manufacturing firm" in the current journal of economic theory 3(3): pp 93-98.

Nyangito, H. O. & Ronge, E. E. (2000), "A review of Kenya's current industrialization policy", KIPPRA Discussion Paper No. 3 of 2000, Kippra

Ng'ang'a, J. C. & Njenga, G. (2010), "Determinants of regional disparity in Kenya", KIPPRA Discussion Paper No. 114 of 2010, Kippra

RPED, (2004), *Investment climate assessment;* in enhancing the competitiveness of Kenya's manufacturing sector, the role of the investment climate.

Rosenthal, S.S. and Strange, W.C. (2003)**, "**Geography, industrial organization andagglomeration"in *the Review of Economics and Statistics*Vol. 85 (2) pp. 377-393.

Samik, V. L. & Sanjoy, C. (2005), "Industrial location and spatial inequality: theory and evidence from India"*Journal of review of development economics*, 9(1), pp. 47-68.

Weber, A. (1929), *Theory of the location of industries*. The University of Chicago Press, Chicago [translated by Carl J. Friedrich].

Woodward, Douglas P. (1992), "Locational determinants of Japanese manufacturing start-ups in the United States," in *Southern Economic Journal*, 58, 690–708.

Wojan, T.R. &Pulver, G.C. (1995), "Location patterns of high growth industries in rural counties" Growth and Change 26: pp. 3-22.

Winkelmann Rainer (2008), *Econometric analysis of count data*, Springer, Verlag Berlin Heidelberg